Using Reference Condition for Wetland Bioassessment in Ohio

Vegetation Index of Biotic Integrity for Ohio inland wetlands

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Current Elements in Ohio's Wetland Program

- Wetland Water Quality Standards
  - Narrative criteria and Chemical criteria
  - "Wetland" designated use
  - Antidegradation rule
- Section 401 Certification Program
  - Post-SWANCC isolated wetland state permitting rule
  - Procedural permitting rules for 401s
- Rapid Assessment Method for Wetlands v.5.0

Ohio's Wetland Water Quality Standards Program

Elements in progress:

- Numeric biological criteria based on vascular plants, amphibians, and macroinvertebrates (2004)
- Standardized mitigation monitoring and evaluation protocols using IBIs
- Watershed or statewide wetland condition assessment methods

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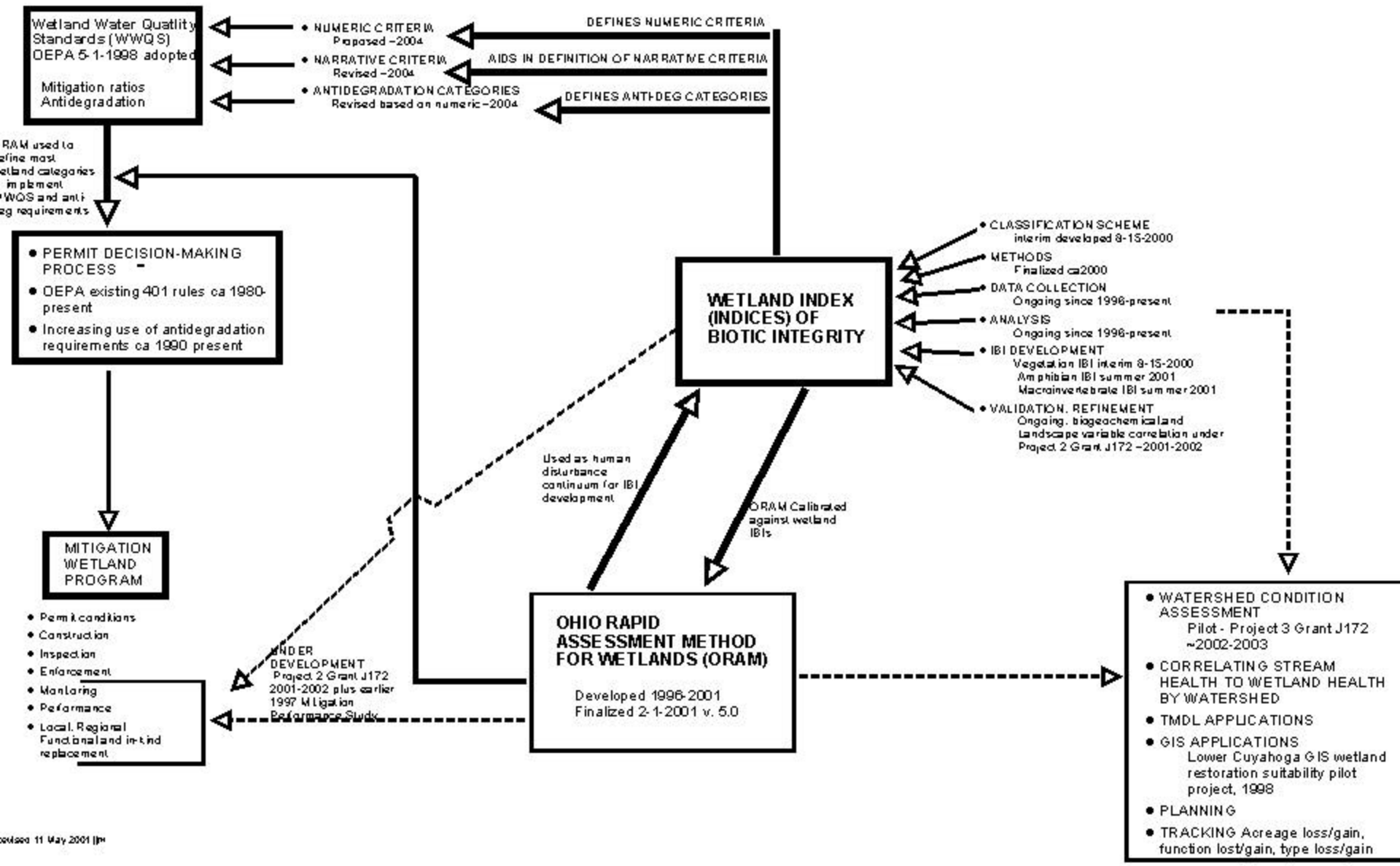
Schematic outline of existing or future components of Ohio wetland regulatory program



Reference Defined

- Reference - IBI/Biocriteria Perspective
  - least impacted, minimally disturbed
  - lacking in obvious human cultural influences
  - all other sites called “nonreference”
    - need sites at both ends of disturbance scale to validate IBI

Reference defined

- Reference from HGM perspective
- Hydrogeomorphic wetland assessment model proposed by Army Corps
- Classifies by landscape position/dominant water source
- Classification critical step in IBI development also

Reference defined

- HGM Reference
  - all sites used to derive and calibrate assessment tool from highly disturbed to least impacted
  - "Reference standard" sites = IBI "reference"
    - least impacted, minimally disturbed
    - "reference standard" used to establish biological performance wetland class capable of

Ohio wetland data set

Summary of numbers of sites by major hydrogeomorphic and plant community classes. Numbers in parentheses are numbers including plots from 2001 field season.

Hydrogeomorphic Classes	N	Plant Community Classes	N
isolated depression	57(69)	various bog communities	6(7)
isolated flats	1(2)	various fen communities	6(11)
riparian mainstem depression	8(12)	marshes (all types)	23(36)
riparian headwater depression	5(8)	sedge-grass communities	3(6)
riparian headwater groundwater	3	shrub swamps	20(23)
slope (riparian and isolated)	8(17)	swamp forests	30(38)
fringing	3		
impoundment	2		
coastal	1(5)		
TOTAL	**88(121)**		**88(121)**

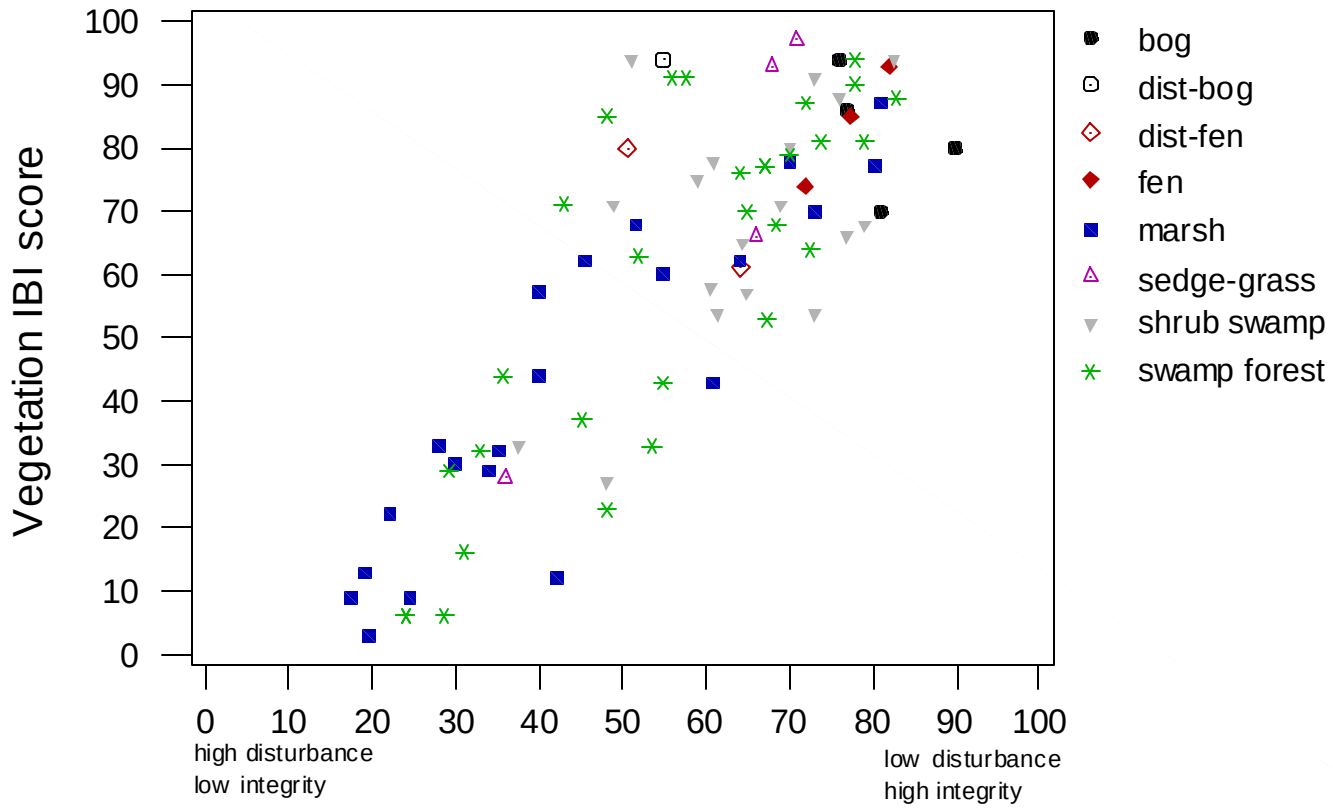
Developing wetland IBIs using vascular plants

- Classification – initial and iterative
- Disturbance scale (x-axis)
- Methods – selection and refinement
- Site selection
- Data analysis – graphical, multivariate, etc.
- IBI development
- validation, testing, and refinement

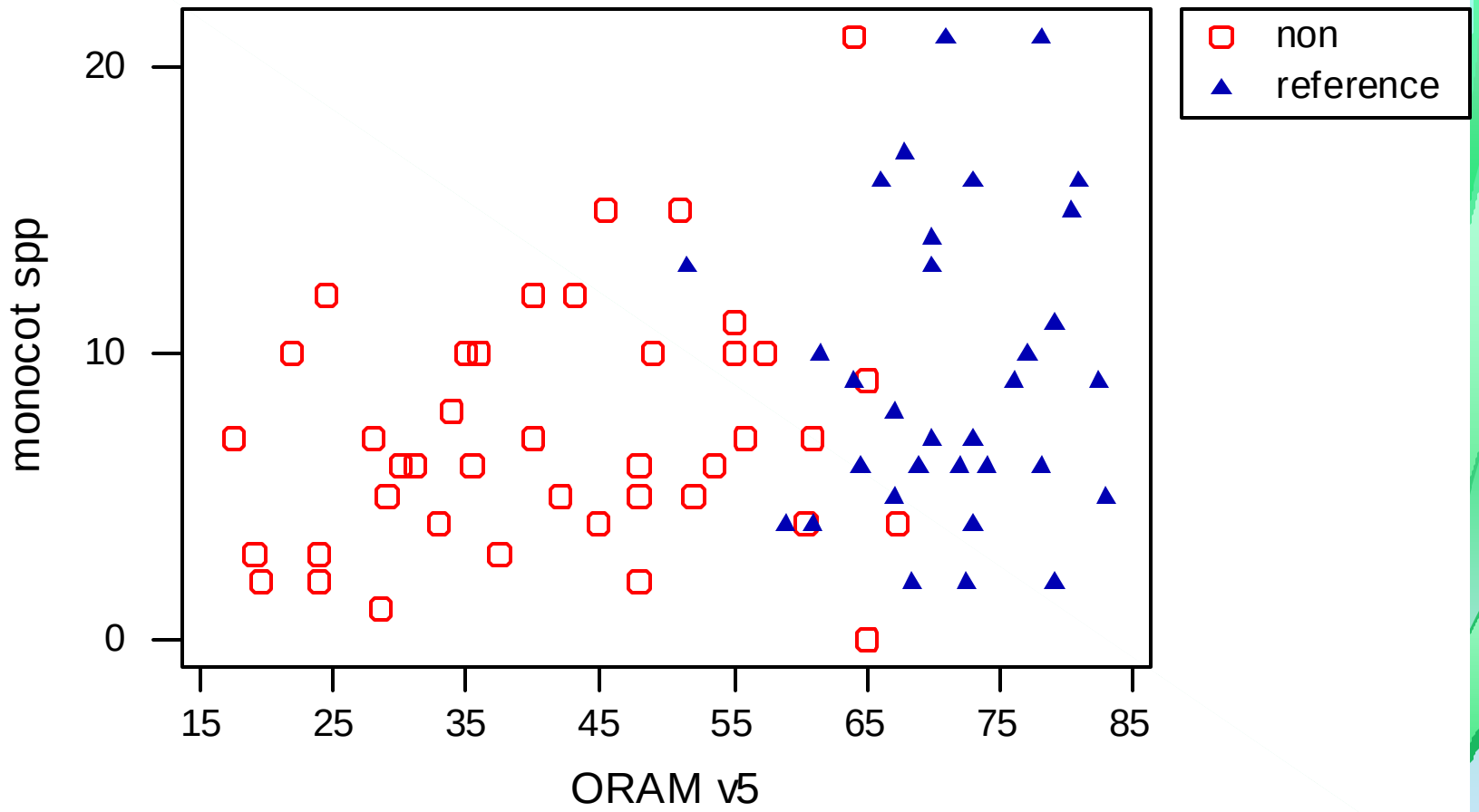
Developing wetland IBIs using vascular plants

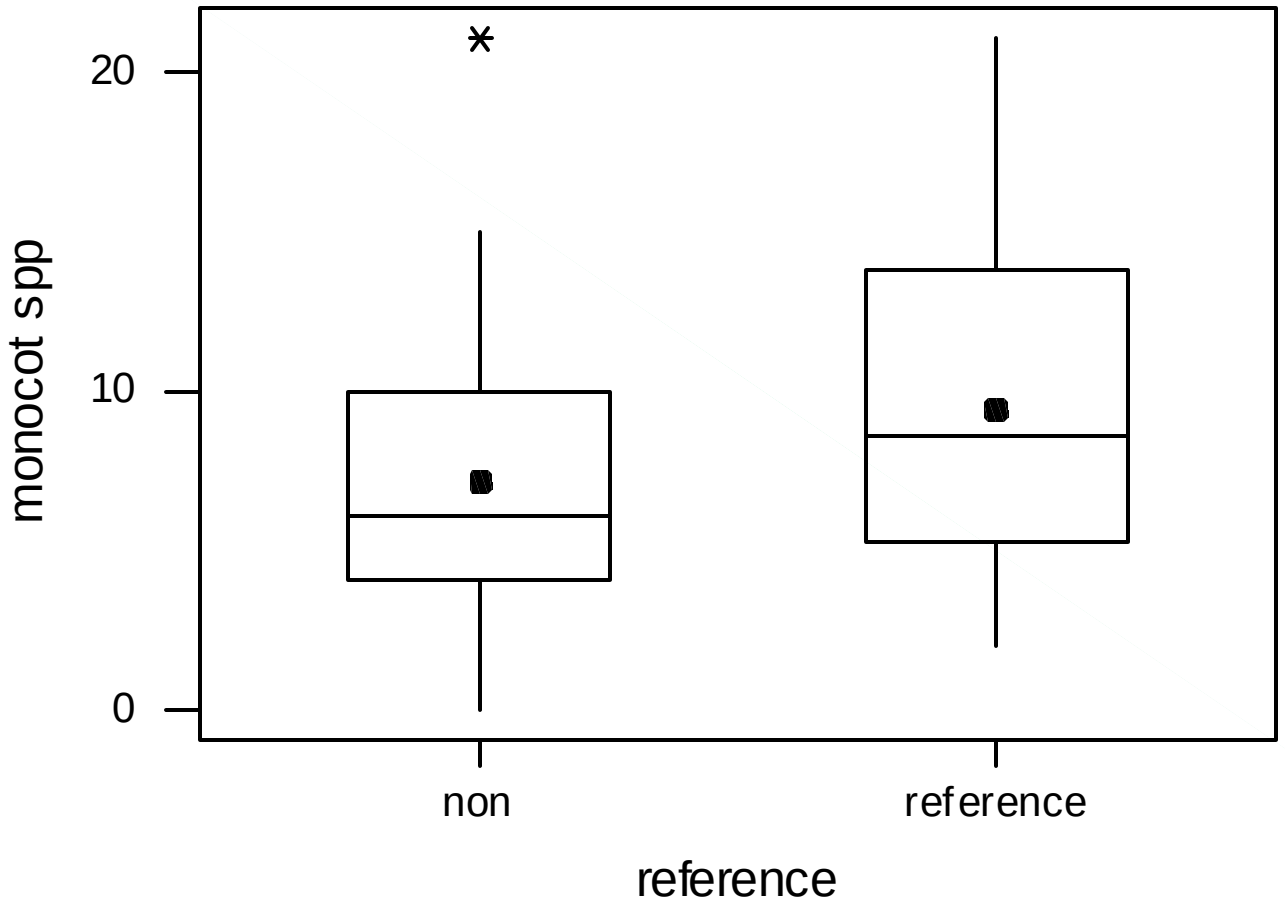
- Classify – Emergent, Forest, Shrub
  - separate IBIs for each type
- Metric selection, evaluation, scoring
- Metric types
  - richness = carex spp., dicot spp., rosaceae spp., hydrophyte spp.
  - indexes = floristic quality assessment index, importance value
  - relative abundance = %tolerant, %intolerant, %invasive graminoids
  - productivity = standing biomass, stand density

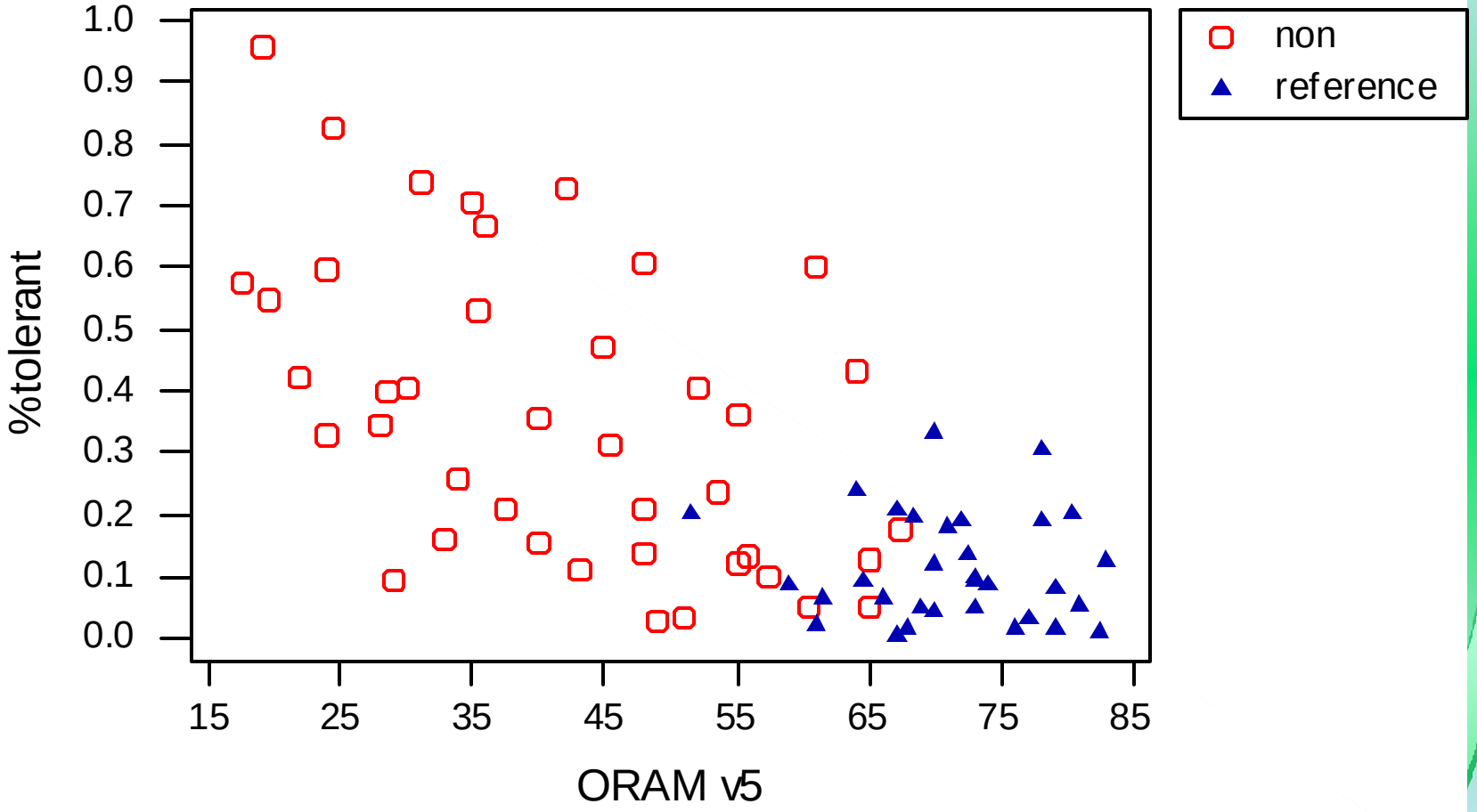
1996-2000 Vegetation IBI dataset



Using reference to select metrics




20
10
0
monocot spp
non
reference
reference


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
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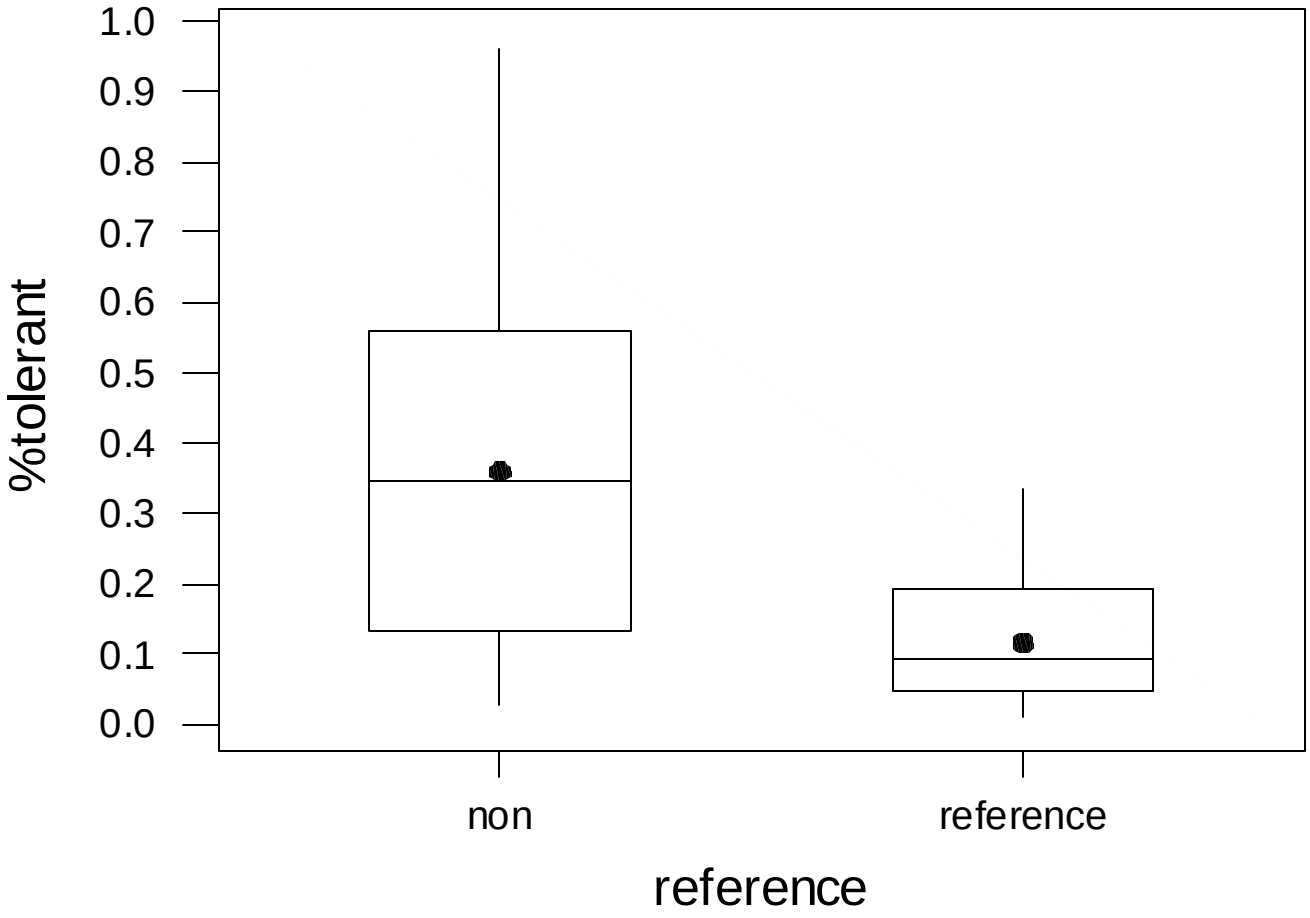
%tolerant
15
25
35
45
55
65
75
85
ORAM v5
non
reference


1.0
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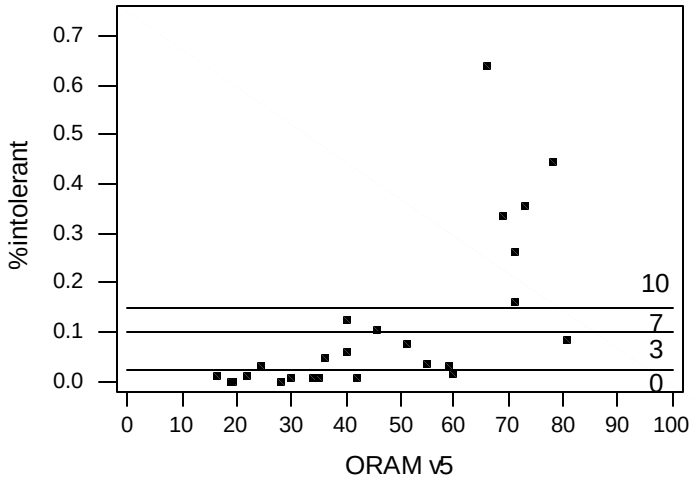
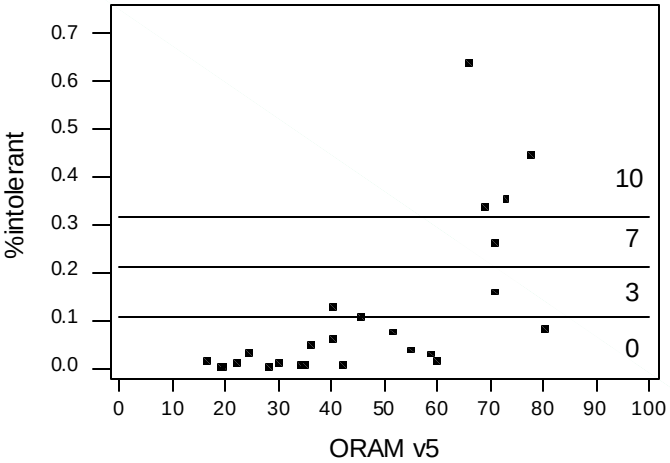
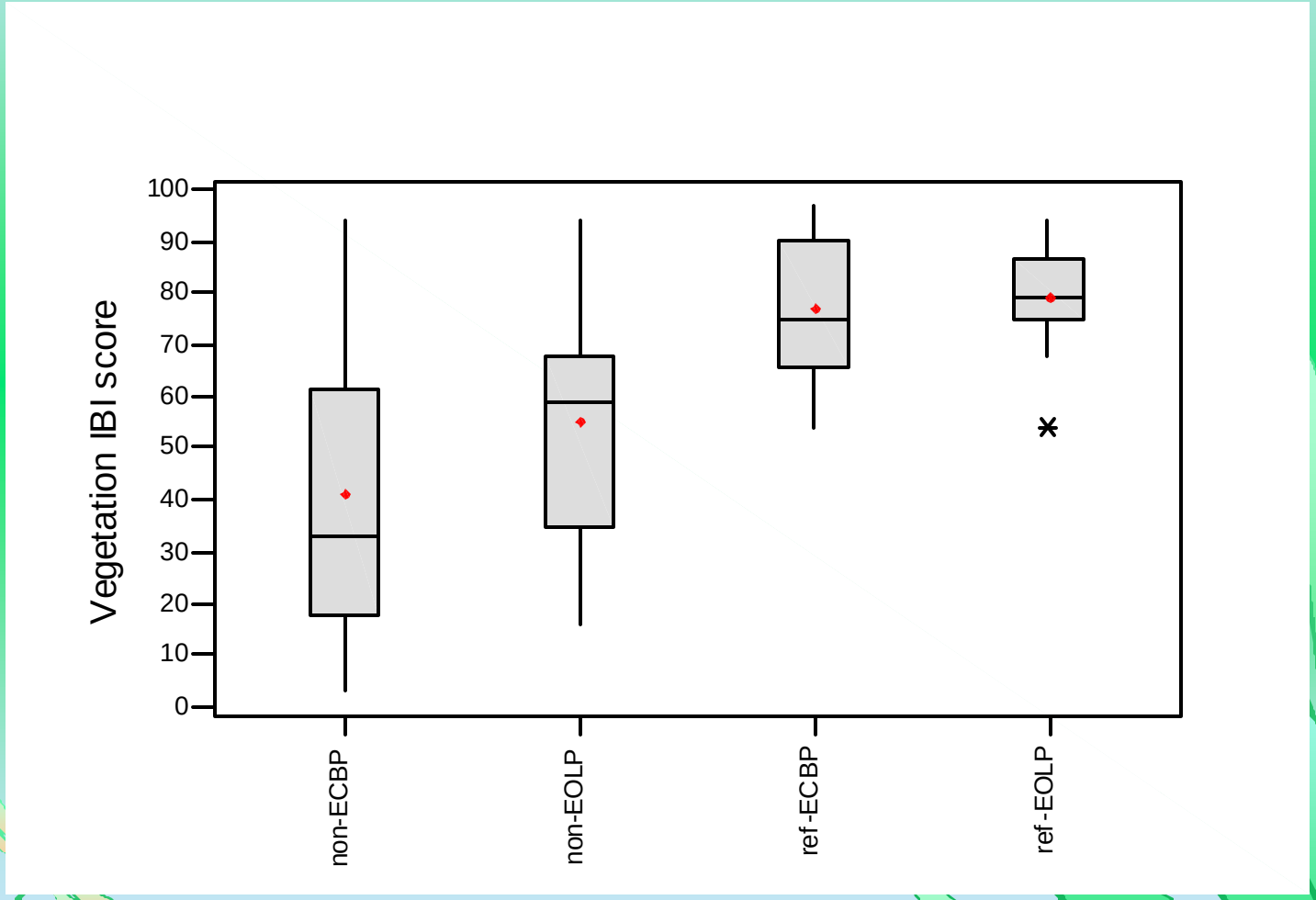
%tolerant
non
reference
reference

Using reference to score metrics





Use reference to define ecoregional expectations

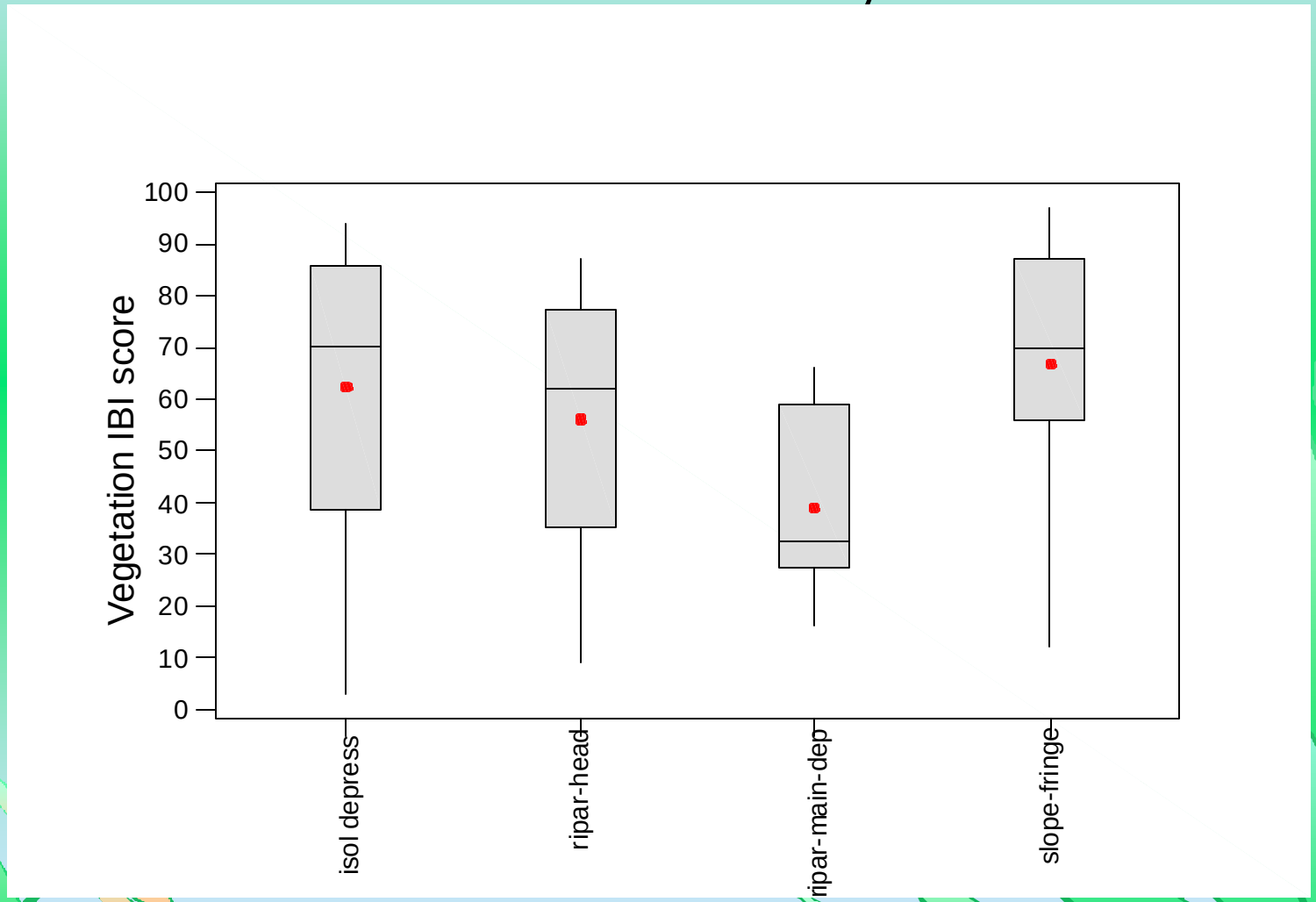


Using reference to define ecoregional expectations

Mean and standard deviation of Vegetation IBI scores for 2 ecoregions and 2 wetland classes (reference and nonreference sites). Bogs and calcareous fens from both ecoregions were excluded from the analysis. Means with shared letters were not significantly different at $p<0.05$ after analysis of variance followed by Tukey's HSD multiple comparison test.

	mean	stdev	N
nonreference ECBP	38.1a	26.3	31
nonreference EOLP	50.7b	22.1	10
reference ECBP	76.9c	13.1	17
reference EOLP	78.3c	9.4	15

Using reference to evaluate classification systems

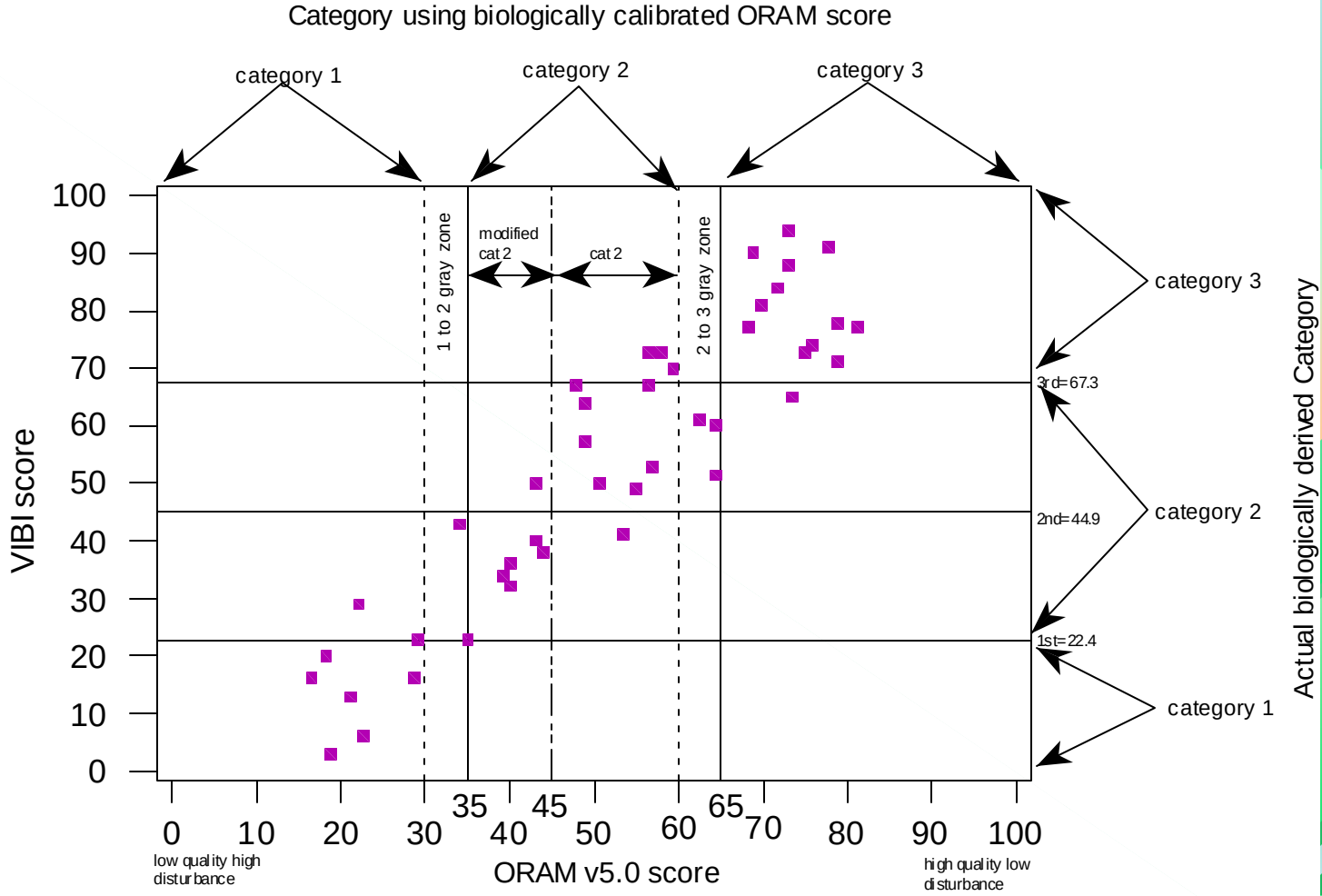


Using reference to evaluate classification systems

Mean and standard deviation of Vegetation IBI scores of all wetlands for 4 dominant hydrogeomorphic classes including fen and bog sites. One headwater impoundment was grouped in the riparian headwater category. No means were significantly different ($p<0.05$) after analysis of variance.

	ALL SITES mean	ALL SITES N	REFERENCE mean	REFERENCE N
isolated depression	62.6(28.0)	56	79.1(11.3)	30
riparian mainstem depression	38.9(17.9)	8	65.0(1.4)	2
riparian-headwater-depression and riparian-headwater-groundwater	55.9(25.3)	9	80.7(5.5)	3
slope and fringing	66.9(25.1)	10	82.0(11.8)	6

Using reference to define regulatory categories



Conclusions

- Reference condition is a powerful, multipurpose concept:
  - objectively defined and able to be determined in field
  - avoids bias by letting landscape and wetlands located in that landscape determine ecological “performance
  - provides objective standard for determining wetland quality as opposed to values and functions assessments
  - useful throughout all steps of IBI development
  - benchmark for developing and calibrating regulatory categorization schemes